RCA III

Influence of Social Trends
on Agricultural Natural Resources

Water Quality, Social Trends and Future Policy

Working Paper No. 19G

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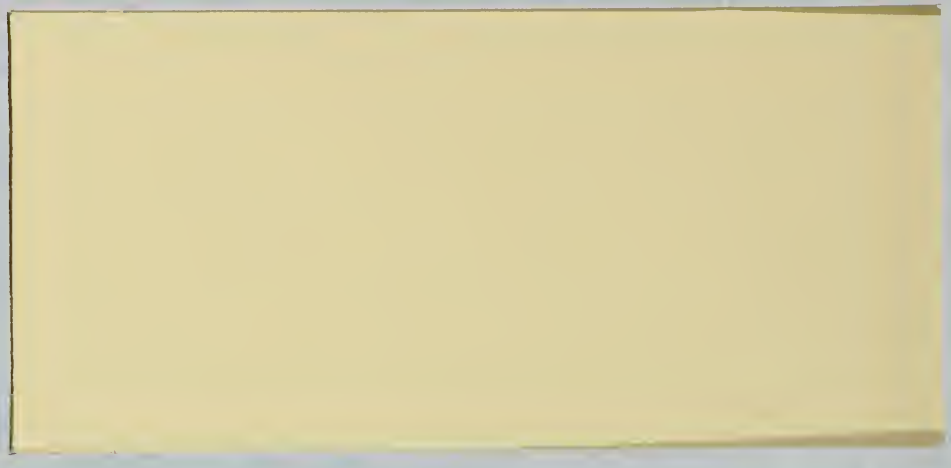

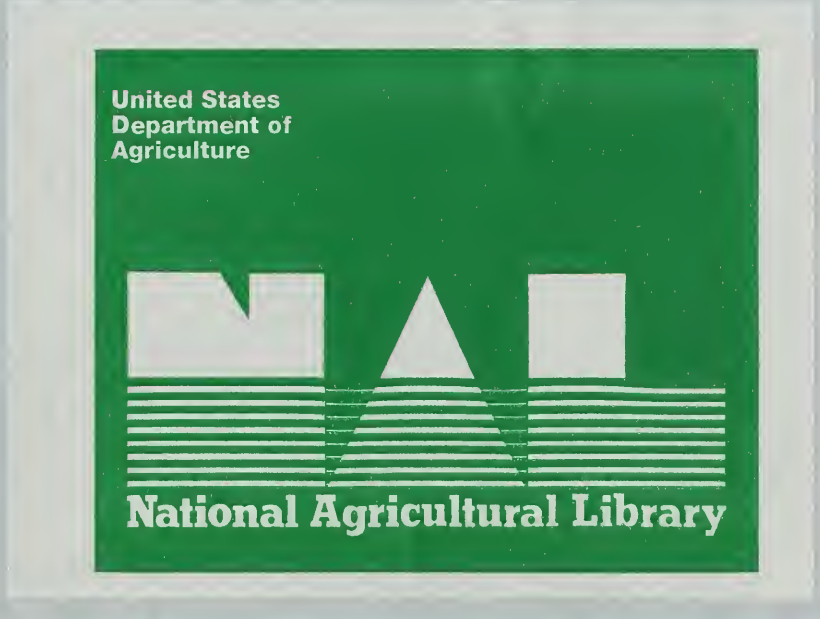
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This is part of a set of papers originally presented at the Symposium on
Influence of Social Trends on Agricultural Natural Resources
cosponsored by RCA and the Social Sciences Institute (NRCS)
(May 31–June 2, 1995, Washington, D.C.)
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Overview of the Symposium

The symposium on *Influence of Social Trends on Agricultural Natural Resources* took place on May 31–June 2, 1995. The speakers presented current trends and were challenged to forecast trends in conservation of our natural resources at two separate points in time—10 and 50 years in the future. This type of forecasting was an unusual challenge to the participants. Many of the "empirically oriented" social scientists chose to remain close to their data, while others did as they were asked and tried to act as seers. Only time will tell how close they came to predicting future scenarios. Assembling any group of scholars will lead to mixed forecasts. Rather than repeat each author's message, we have tried to emphasize some common themes in the presentations. If you want to find out what the authors themselves think, read the papers. It is well worth the effort.

Although the attitudes of the public and the agricultural community differ on some issues, support for a clean agricultural environment is almost universal. The public is concerned for the safety of food and water supplies. The public also feels that laws on threatened and endangered species and wetlands are just right or have not gone far enough in providing protection. Most farmers and ranchers, along with the public, support a federal role in agricultural conservation, especially in incentive payments to promote conservation.

Most of the public would like to see federal spending on agricultural conservation increase or remain the same. The desire of the public and agricultural communities to have an incentive-based system has been partly realized with the passage of the 1985, 1990, and 1996 Farm Bills (respectively Food Security Act of 1985; Food, Agriculture, Conservation, and Trade Act of 1990; and Federal Agriculture Improvement and Reform Act of 1996). Concurrently, the public supports regulation, fines, and withholding government benefits when voluntary conservation is not working. A majority view among presenters was that with time there would be an expanded regulatory role for all levels of government vis-à-vis production agriculture. There was some disagreement on whether this expanded regulatory role would come through the use of centralized, command-and-control regulations or through the use of market-based incentives.

When given an opportunity to voice their opinions regarding conservation compliance, most farmers with highly erodible land supported the program and did not want Congress to abolish it when crafting the 1996 Farm Bill. Furthermore, farmers with highly erodible land and conservation compliance plans believed that NRCS was more than fair in its implementation of conservation compliance planning. Over the last 5 years (the period during which farmers had to acquire their plans and have them fully implemented), farmers have been consistent in their support of the program. However, there is a troubling drop in the percentage of farmers with conservation compliance plans who believe that monitoring and enforcement are being carried out in such a way that farmers who are out of compliance will be found out and will lose eligibility for USDA program benefits.

The environment and ecosystem management will remain important future issues for the public and agricultural producers. During the next 50 years, as the global population continues to grow, agricultural producers and agribusinesses will be challenged to expand food production and the processing and distribution systems to keep pace with population growth without endangering the ecosystems supporting production agriculture. In industrialized countries, alternative food sources will be developed, environmental monitoring will become more widespread and more precise, and new environmentally benign methods of production agriculture and food processing will be developed. Given capital limitations, resource constraints, and increasing demand for food, the poorer countries will face growing environmental challenges as they use their physical resources more intensively in the effort to feed their populations and expand their trade abroad. Sources of environmental stress will be in the energy, manufacturing, and extractive industries in addition to agriculture. The future of humanity will depend on the development and sharing of appropriate technologies and mobilizing global efforts to effectively control population, produce enough food and fiber, and protect the environment.

A number of papers underscored the structural transformation underway in the agricultural and financial sectors. Increased vertical integration and the separation of land and resource ownership for farm operations are rapidly changing the character of agriculture. For example, one author suggested that in the 1980s banking and finance became more national, if not global, as local banks and credit unions—especially in rural areas—went out of business. The cold dollars-and-cents business world of finance merges uncomfortably with the inherent instability of agriculture and the accompanying fluctuations of farm income. During the next 10 years, income in the agricultural sector may be even more volatile, due to the elimination of the farm income safety net. With the gradual removal of this safety net through the 1996 Farm Bill, farmers will face increased financial risk and greater uncertainty. A challenge for operators will be the development of strategies for shifting the increased risk from themselves to others.

One consequence of the consolidation within the financial sector will be the shifting of funds away from rural areas and the increased reliance of farmers on capital and operating loans coming more from commodity processors and input suppliers than from traditional banking sources. Corporations will begin to own more agricultural land, and for the land they do not own, they will contract with farmers as to what to produce and how to produce it in exchange for a guaranteed market for the commodity. In many instances, the farmers will be no more than salaried workers. One impact of these changes will be to make farmers dependent on agribusinesses. Farmers and farm managers will have a vested interest in production, not conservation. In this transformed world of agriculture, a major challenge will be the public sector's voice demanding food safety, environmental quality, and worker health and safety.

Much of the livestock industry—cattle, chickens, hogs, turkeys, and sheep—is currently controlled by a few companies. In addition to livestock conglomerates, industrial consolida-

tions of port facilities and feed, elevator, milling, and soybean-crushing plants limit market access for individual producers. Companies that contract for agricultural products are not typically held responsible for environmental impacts, while individual producers are. Hence, while agricultural processors will increasingly specify what to produce and how to produce it, the environmental consequences of those specifications will shift to individual producers. However, the public will exert enough pressure so that environmental responsibilities will likely be pinpointed as this type of agricultural concentration increases. Not only will concentration of production and processing take place in the livestock sector, it will also occur with grain and oilseed crops, their processing, and the transportation of all agricultural commodities. Farmers, public interest groups, and government officials are just now becoming aware of the structural changes sweeping over agriculture and of the implications they hold for producers, consumers, and the environment.

Crop biotechnology is not currently and will not in the next 10 years be a significant factor in relation to environmental quality. However, some aspects of agricultural industry are more directly affected by biotechnology than others. For example, the livestock industry has been affected through the development of growth hormones and vaccines for increasing livestock production. In contrast, it is more difficult to manipulate cereal grains through bioengineering technology than was thought at first. In fact, these common grains may be easier to modify through conventional breeding techniques that improve multiple genetic (polygenic) traits than by the use of biotechnology, which focuses more easily on single genetic traits.

Crop biotechnology (e.g., herbicide- and pesticide-resistant crop varieties) is following an established technological trajectory rather than defining a new path. Some of these developments feed into existing monocultural practices (with their attendant environmental problems) and limit the use of crop rotations. Mechanization and industrialization are the current dominant trends in agriculture, and biotechnology complements these trends. Biotechnology will have mixed effects on environmental quality, and its impact depends to a great degree on how public policy is implemented in the environmental arena.

Several researchers projected that national conservation institutions over the next decade will remain in place but with reduced funding. State and local institutions will need to significantly increase resources directed toward conservation. Stronger agricultural regulations will be passed at the state and local levels. However, in general, states and local areas do not have the financial capabilities to provide full-service technical assistance and cost-sharing for conservation, nor do they have the staff capabilities to regulate the agricultural industry. In fact, one of the challenges is not only the extent to which states can pass legislation on soil and water conservation but the extent to which they can implement and administer the laws they have. Presenters recommend that state and local political institutions acquire taxing authorities so they can more directly provide staff assistance and incentives to foster natural resource protection and enhancement at the local level. While state and local units of government could assume greater responsibility for soil and water conservation programs,

an important challenge will be how much *both* the agricultural and nonagricultural communities are involved in decisionmaking, as well as how closely local concerns reflect the environmental concerns of the wider community.

The projected unit of analysis for agricultural conservation work is at the watershed level. While this unit may be very appropriate for ecosystem planning (e.g., ecological linkages across a landscape, a context for socioeconomic-political institutions), it presents a number of challenges that have to be addressed if the watershed approach is going to achieve its promise. For example, what is the spatial scale at which a watershed is defined? Is a large-scale or small-scale approach taken to delineate watersheds for planning purposes? Another question is, what criteria are used to separate watersheds: are they biological, social, or topographic in nature? How can watershed planning be reconciled with various overlapping levels of government that have to be coordinated and through which administrative control of conservation policy is exercised? And finally, how can procedural and substantive issues of the wide variety of organizational missions be addressed at a watershed level?

The idea came up repeatedly that while most farmers and ranchers use sound conservation systems, 10 to 15 percent of them are "bad actors." These producers are unaware of or choose to ignore the negative effects of their production systems on the environment. It will be extremely difficult to change the behavior of these people. Participants felt that the larger society will eventually demand that the bad actors be penalized for polluting the environment. The penalties might come as fines, stricter environmental regulation and enforcement, or more programs like conservation compliance. Two forces are at work. First, the structural changes taking place in agriculture are working to destroy the Jeffersonian image of the yeoman farmer that gives farming special status vis-à-vis environmental regulation. Second, more and clearer information about the interaction of production agriculture and environmental quality will result in stronger public demand for environmental protection. Improved resource inventories will facilitate the tracking of environmental degradation and the levying of penalties. Resource inventories will become more important in the future, based on two trends: *increased accountability* for scarce financial resources, and *advancing scientific capabilities* that increase the ability of conservation partners to assess and monitor environmental conditions.

Environmental justice was another topic discussed. Industry and agriculture have taken advantage of minorities by ignoring the effect of agricultural pollutants on minority populations and by placing chemical production, waste facilities, or concentrated farm operations in minority communities. A Presidential Executive Order on Environmental Justice (Executive Order 12898) attempts to address this issue. During the next 10 years, increased awareness of these issues in minority communities will merge with more reliable and accessible information to slow but not stop these negative impacts. The "not in my backyard" movement, a classic middle-class movement, helps to relocate agricultural pollution to minority areas. It will take many years before this entrenched trend is offset.

The future moves erratically, with many choices that each yield unclear results. History has the advantage of being able to look back to add meaning to society's many bends in the road. The exercise of looking ahead 10 and 50 years forces researchers to rely on their basic assumptions about the nature of human beings as well as the influence that systems wield on future events. Skepticism and optimism were the yin and the yang of this symposium. Comparing the present to a future ideal is frustrating because, in some cases, the present environment is toxic to living creatures. However, at the same time, there is room for optimism. The continuing environmental movement in general has been strengthened and sculpted by the legislative and executive branches of different levels of government. This can be attributed to the public's strong support for wetlands, wise use of agrichemicals, food safety, water quality, threatened and endangered species, and safe recreational opportunities. The public also supports localized decisionmaking, which puts human and physical resources in local hands.

As we look 50 years into the future, the trend toward the industrialization of the agricultural sector is bound to accelerate. It seems conservationists are presently pushing their bandwagon down a slight grade because of the public's support. To speed up the wagon, we must institutionalize two new inputs besides the traditional inputs of land, labor, technology, and capital. These added inputs are *environmental considerations* and *fairness/equity*. As these inputs become standard costs for doing business, the agricultural sector will realize its potential to be healthy, fair, and productive.

Frank Clearfield and Steven Kraft

June 1997

Abstract

This essay addresses agricultural conservation policy from the perspective of water quality and aquatic ecosystems. The first part focuses on how and why agricultural conservation issues have become more and more prominent in the water quality arena, and why they have been inadequately dealt with in both water policy and agricultural policy to date. The second part focuses on the problems of making and implementing effective policy to deal with problems of surface-water and ground-water quality in agriculture and provides some ideas for overcoming these problems at three future time intervals: 0 to 3 years, 3 to 10 years, and beyond 10 years.

Keywords: water quality, Conservation Reserve Program, wetlands, watershed management, environmental policy, 1995 Farm Bill, Clean Water Act

The Influence of Social and Agricultural Trends on Water Quality

Implications for Future Policies

Christopher L. Lant

The End of the Engineering Era in Water Quality Management

Rogers' (1993) book, *America's Water,* states that the basic tasks of (1) developing renewable fresh water supplies for human use, (2) providing safe drinking water, and (3) controlling gross industrial "point sources" of pollution are essentially complete. Each of these tasks has largely been accomplished through engineering, the first through civil engineering (construction of dams and water delivery systems), and the latter two through environmental engineering (treatment of drinking water and sewage). But new issues are on the agenda, according to Rogers, and they include (1) ground water management, (2) control of diffuse (nonpoint) pollution, (3) wetlands regulation, and (4) ambient water quality, or more broadly, aquatic ecosystems. I strongly agree with Rogers, but of particular interest is that each of these four issues, plus overconsumption of water in irrigation, is strongly related to the environmental externalities of contemporary agricultural production, and none can be solved primarily through engineering techniques.

There are at least two primary reasons why U.S. policy has focused on engineering solutions to water resources problems. The first is the inherent tractability of the problems addressed. Sabatier and Mazmanian (1981), in an insightful model of policy implementation, define the tractability of a problem in terms of (1) the availability of a valid technical theory and technology, (2) the diversity of target-group behavior, (3) the extent of behavioral change required, and (4) the target group as a percentage of the population. "Nonpoint" or, better put, "runoff" sources of pollution deliver the vast majority of suspended and dissolved solids, BOD, N, and P to the nation's waters, but if we compare point-source and runoff-source water quality problems, it is clear that the former is a more tractable problem to attempt to solve through environmental policy. Scientific understanding of how to treat sewage, for example, is much more advanced than knowledge on how to provide filters for polluted runoff at critical locations in the agricultural landscape. Although GIS techniques are currently generating considerable scientific progress, field-based runoff pollution models such as CREAMS and AGNPS are not yet able to model whole river basins (Bennett, personal communication). For this reason, it is not currently possible to model land use and

agricultural practice scenarios in order to identify the source of pollutants or the most advantageous fields to target for BMPs at a river basin scale.

"Point" sources by definition are focused at particular locations, whereas runoff sources are distributed widely across this vast nation. Industrial and municipal point sources are also far fewer in number than farms and other land uses that contribute to polluted runoff and leachate. Moreover, subtle variations in physical geography and agricultural production techniques make implementation of best management practices much more variable and site-specific than standardized techniques of wastewater treatment.

The second reason is political. Reisner (1986) and other writers have identified an "iron triangle" that has maintained the water engineering industry through the end of the dam building era and well into the drinking water and sewage treatment plant building era. Since 1970, the United States has spent at least $473 billion to build, operate and administer pollution control facilities (Doppelt, et al., 1993). Thus, the political machinery for continued funding for engineering solutions to point-source problems through the Clean Water Act (CWA) and the Safe Drinking Water Act has been well oiled, at least until this year, should spending restrictions in H.R. 961 become law. The failure of the 208 and subsequent 319 provisions of the CWA to seriously address runoff pollution problems (Adler, 1994), and the unlikelihood that a substantial effort will be mounted in the Clean Water Act reauthorization bills now being considered by Congress (see H.R. 961), are ample evidence of the "stepchild" nature of runoff pollution problems, where agriculture is the primary focus, in the water quality arena. In fact, the point/nonpoint federal spending ratio has increased from 15 in 1972 to 53 in 1995 (Adler, et al., 1993).

The "Watershed Management" Oxymoron

Another aspect of the failure to control the impact of agriculture on water quality is the weakness of current institutions for watershed management, particularly in predominantly agricultural watersheds where most land is privately owned. Many scholars of water resources in the United States have observed the fragmentation of decision-making that constitutes watershed (mis)management (for example, Feldman, 1991; Viessman, 1990). In fact, watershed management in the United States has been hampered by a number of scientific and social factors, so much so that the term itself is appropriate in only a small number of special situations on large contiguous blocks of federal land. Deyle (1995) observes that the fragmented decision-making that is typical of watershed management constitutes an "organized anarchy" where the involvement of stakeholders is fluid and goals and the means of achieving them are poorly specified. He argues persuasively that these circumstances result in what Cohen et al. (1979) describe as "garbage can decision-making" where independent streams of choice opportunities, problems, solutions and participants produce the "pet" solutions of agents who are only temporarily cooperating to address a particular water resources problem.

The results of this style of "management" have been particularly detrimental to the aquatic and wetland ecosystems of the United States in the 20th century. Karr et al. (1985) document a history of degradation on two primarily agricultural river basins, the Maumee and the Illinois River, where two-thirds of the fishes are extirpated or in decline, bringing to a complete halt what was in 1900 the second greatest freshwater commercial fishery in the United States. Wetland ecosystems have fared little better. About half of the wetlands occurring in the contiguous United States in 1900 and over 90 percent in the Corn Belt states of Illinois, Indiana, Iowa, and Ohio have been drained (McCorvie and Lant, 1993). While these represent some of the most outstanding examples of aquatic and wetland ecological decline in agricultural watersheds, broad cross-sectional data also indicate a general problem of riverine ecosystem simplification attributable to overfishing, introduction of exotic species, fish migration blockage due to dams, chemical contaminants, channel modifications, excessive water withdrawals, erosion and sedimentation, deterioration of substrate quality, and elimination of natural riparian vegetation (Doppelt et al., 1993; Karr and Schlosser, 1978). Agriculture takes an increasing share of the blame as we go down the list (table 1).

Nor does the Clean Water Act provide the needed framework for watershed management. Runoff control efforts of the Clean Water Act have been "weak, poorly funded and ineffective" (Adler, 1994, p. 803). Doppelt et al. (1993) observe that the Clean Water Act is "ineffective in protecting or restoring riverine systems and biodiversity on private-land rivers" (p. 342). The Clean Water Act Section 404 program has also been mentioned as a political lever with which to manage land use patterns in watersheds (Gosselink, et al. 1990), but is likewise applicable in few areas outside of Louisiana because jurisdictional wetlands do not occupy most of the critical zones in the watershed. H.R. 961 contains little that would

Table 1. Relative role of agriculture in generating aquatic ecological impacts

Ecosystem impact	Role of agriculture
Overfishing	none
Exotic species	none
Dam blockage	none
Chemical contaminants	moderate
Channel modifications	moderate
Excessive water withdrawals	large
Erosion and sedimentation	large
Deterioration of substrate quality	large
Elimination of riparian zone	large

change this situation, although it does include a Section 321 "State Watershed Management Programs" that provides general guidelines for voluntary state efforts, much like Section 319 of the current Clean Water Act.

Despite Hunter's (1988) persuasive "call for judicial protection of the public's interest in environmentally critical resources," managing agricultural land use in watersheds is made particularly problematic by the limitations of government regulatory authority, particularly the "takings" issue. Lant (1994) observes in the context of wetlands and Weibe (1995, this symposium) observes in evaluating H.R. 925 ("Private Property Rights," which passed the House, 277 to 148, on March 3, 1995) that the U.S. Supreme Court has not established a clear test on what constitutes a regulatory taking. While the court has upheld nuisance law and maintained that diminution of market value alone does not constitute a taking, the constitutionality of agricultural land use limitations that would be necessary for effective watershed management remains in question. Moreover, Lamb and Lord (1992) have found that legal protection of riparian areas, which Karr and Schlosser (1978) and Doppelt et al. (1993) view as absolutely necessary for the integrity of aquatic ecosystems, is very weak to nonexistent. These legal issues are critical to management of agricultural watersheds because the use of private rural land is determined largely by the economics of agricultural commodity and wood-product markets and government programs to regulate them, as well as by environmental and lifestyle attitudes that are unrelated to water concerns.

In practice, therefore, the mechanics of watershed management are today not well developed in agricultural areas where land is predominately owned by private individuals. In such settings, hydrologic and ecologic processes are influenced by the cumulative impact of spatially distributed, independent land-use managers, who do not necessarily perceive or have a direct interest in the cumulative impacts of their actions. Dixon (1987) terms this dilemma "the tyranny of small decisions."

Innovative Policy Tools for the Future

The context in which U.S. environmental policy works to control agricultural water quality problems is rapidly changing. Currently, voluntarism and technical assistance (the ongoing role of NRCS), cross-compliance measures (Conservation Compliance, Swampbuster), and positive economic incentive programs (CRP, WRP, WQIP) play a dominant role, while negative incentive measures (e.g. taxes on farm chemicals or erosion) and direct regulation (e.g. outlawing row crop production within a certain distance from perennial streams) play a minor role. This particular mix of policy tools will likely change in the near future, although greater direct regulation, especially at a federal level, is neither the best nor the most likely option. As Sabatier and Mazmanian (1981) point out, "only by mixing distributive with regulatory policies can substantial changes in target-group behavior be achieved."

First, at a time scale relevant to the next Farm Bill, Congress is likely to substantially cut and perhaps also to substantially change agricultural subsidy programs (Cox, 1995). Cutting

agricultural subsidies has three immediate impacts on water quality; the first two are positive (for water quality if not for farm income), the last is negative. First, to the extent that farmers respond to falling effective commodity prices as economic theory predicts (by reducing production inputs to the point where marginal production costs and marginal revenues per unit are equated), cutting price supports decreases agrichemical inputs. Second, this decrease in effective commodity prices makes more financially attractive positive economic incentive programs like the CRP, WRP, and WQIP, or a new Environmental Quality Incentives Program that is now being discussed in Congress (Cox, 1995), *if* they continue to be made available. Third, the less the importance of subsidies to the financial survival of farm enterprizes, the less the incentive to remain eligible for such subsidies, and therefore the less effective cross-compliance is as a policy tool. This could result in some farmers abandoning conservation compliance plans or draining wetlands as they leave commodity programs (Heimlich and Langner, 1986). Therefore, by the end of the century agricultural conservation policy must necessarily shift from an emphasis on cross-compliance to an emphasis on other policy tools, particularly positive economic incentives. That is, not only does the reduction in commodity-based subsidies free up resources for conservation programs, it also makes this shift necessary since the environmental benefits that cross-compliance provides will be partly lost. Additionally, while its impact on water is unpredictable, a move away from the base acreage system frees farmers to experiment with crops more broadly, with incalculable long-term economic and environmental benefits (Faeth, 1995). A 1995 publication by the American Farmland Trust does an admirable job of suggesting policies to address these issues.

A second focus for the short term is prioritizing renewal of CRP contracts on the basis of cost-effective environmental benefits. Barbarika et al. (1994) have shown that the geography of CRP contracts that would be renewed varies greatly depending on the criterion used to evaluate existing contracts. An emphasis on lowest cost per acre or cost-effective erosion reduction would focus contract renewal in the Great Plains. An emphasis on water quality and other environmental benefits would focus it in the Corn Belt, and weighting these factors by population would focus it in the Great Lakes and Chesapeake Bay watersheds. But, as American Farmland Trust (1995) point out, we should think not only of which contracts to renew, but of a shift of overall enrollment with expiration of contracts on farmlands with low productivity, low environmental values and a small probability of returning to crop production, and new contracts on environmentally critical croplands such as filter strips, farmed wetlands, and areas at risk of ground water contamination. This kind of CRP would cost more per acre (Lant et al., 1995) but would provide correspondingly greater environmental benefits, particularly for water quality and aquatic ecosystems.

In the intermediate term (3–10 years), it is important to revisit some policy tools that are not now being used to a considerable extent. In particular, taxes on agrichemicals make a great deal of sense and need not work to the overall financial detriment of farmers (Zilberman, et al. 1991). Taxes are much more easily implemented than the type of micro-

management that results from detailed regulations enforced by an already overburdened NRCS. They level the economic playing field by internalizing externalities and by being applied evenly, at least at a national scale (Roberts and Lighthall, 1991). A critical factor in their implementation, however, is the elasticity of demand for various agrichemicals, which has, in general, been estimated to be small (Duke, 1994). But that means that in the short term they raise revenue that can be used for other purposes, such as land-use-based economic incentives or property tax relief, and in the long term elasticities will likely rise as they have for other production inputs like energy and water (Cameron and Wright, 1990). That is, in the long term farmers can make adjustments in the technology through which they apply chemicals and the crops on which they are applied. Taxes, as opposed to regulations, allow individual farmers to make the adjustments necessary to equalize marginal production costs with marginal revenues as economic theory prescribes. Finally, as they do so, aggregate production falls, which will increase prices for agricultural commodities and thus profit margins for farmers so long as demand does not fall simultaneously.

Making predictions for the long term is inherently risky, especially given what chaos theory now tells us about the sensitivity of initial conditions and the resulting unpredictable behavior of complex systems. Perhaps the Chinese metaphor, where we face the past, seeing the recent past clearly and the distant past broadly, but back our way blindly into the future, captures our limitations best. Nevertheless, we can perhaps identify the factors that govern the systems we are interested in, even though we cannot know how those factors will behave in the future. With these caveats in mind, in the long term (beyond 10 years) agricultural conservation policy will be greatly influenced by the same exogenous factors or trends that govern it today. These are (1) effective global demand for agricultural commodities, which will depend more on international trade policy and the geography of income growth than on population growth per se; (2) the overall course of the environmental movement, especially as it drives values and attitudes toward food, agro-ecosystems, aquatic and wetland ecosystems, and suburban sprawl; (3) changes in the industrial structure of agriculture, especially increasing concentration (Heffernan, 1995) and the growth of a secondary organic food industry (Duram, 1994); and (4) advances in agricultural production technology (especially biotechnology). These trends will require that new policy approaches and research agendas be explored. For example, biotechnology promises to make an important contribution to increasing agricultural production beyond the next decade (Buttel, 1995), but at a high input cost, and possibly at a high environmental cost. This will likely mean that investments in biotechnology will be profitable only on the most inherently productive land, where returns to investments in advanced genetic applications are greatest. This would have the effect of further concentrating agricultural production upon the most favorable regions and the most technologically competent producers. The production from these regions would increasingly dominate commodity markets, further marginalizing agricultural production on less productive land and by farmers who are unable to keep pace

with genetic innovations (after Cochrane, 1977), unless those farmers are able to capture secondary organic food markets.

From an environmental perspective, biotechnology may or may not be good for water quality and aquatic ecosystems depending on whether these concerns are incorporated in the research thrust that generates agricultural applications of advanced genetics (Buttel, 1995, this symposium). Increasing production per acre, in the absence of rapidly growing effective global demand, would leave us with an even larger "problem" of retiring less-than-prime farmland from crop production. But how will such land be managed, by whom, and for what objectives?

What I think will be needed in the long term is "publicly-supported rural landscape managers" as distinct from commodity-producing farmers and increasingly large agribusinesses. The public has begun to demand more from farmers and farmland than efficient production of agricultural commodities. And this trend will accelerate as niche markets for organic produce grow, as red meat consumption falls, and as the increasing proportion of the population that is characterized as suburban or as "rural, non-farm" looks to the local rural landscape and water resources for recreational opportunities and environmental and aesthetic values.

The CRP and WRP are first steps in the right direction because eligibility of land is based on environmental characteristics, because they introduce the concept of a conservation easement broadly among the farming community, and because they leave the farmer, who knows the details of particular plots of land best, who oversees it frequently if not continuously, and who has the greatest long-term stake in the quality of the land, directly responsible for land management. But we need to go beyond these two programs. As Californians know best, conservation easements are a wonderfully flexible policy tool that can be applied for any length of time and for a number of different environmental purposes (Diehl and Barrett, 1988).

Finally, the impacts of agricultural production on water quality are best addressed by collective action at the local level through new watershed management institutions such as watershed alliances. Lee (1992), in a paper that deserves to be widely read, concludes that "what we do know with certainty is that sustainable watershed management begins by building ecologically effective human organizations. This fact alone must stand as a centerpiece of a new perspective on watershed management" (p. 87). Doppelt et al. (1993) insist that for management of water quality and aquatic resources to be effective in largely private (i.e. agricultural) watersheds, "a mechanism must be established to empower local communities, and to develop links between a wide diversity of interest groups to become engaged in bottom-up watershed restoration programs" (p. 65).

But establishing such institutions is difficult because it must overcome what Lee (1992) describes as "information flow pathologies." That is, the water quality problems of agriculture will not be effectively addressed if they are consistently viewed as "someone else's problem." Farmers and rural land managers must begin to see their lands as occupying

particular locations within a watershed, much as they now see them in relation to their home county, and that they have a common interest, together with other inhabitants of the watershed, in the water quality and ecological integrity that their home watershed manifests. As Americans become more and more interested in having some influence over the forces that create their local living environment, I see no reason why these new institutions cannot evolve in the early twenty-first century.

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Watershed Management to Address Agricultural Pollution: Past, Present and Future

Robert W. Adler
Associate Professor, University of Utah College of Law

I. Introduction

Water resources scholar Dr. Martin Reuss wrote recently:

> Since before the Civil War, every few years some professional, private or public organization sponsors a water policy conference. The flurry of recommendations following each conference, often ending in bureaucratic oblivion rather than in substantive change, reflects futility as much as ambition. The United States seems historically incapable of establishing a water policy and certainly has not found the key to reconciling rational natural resource administration with its pluralist, federalist system of government.[1]

The proposals alluded to by Dr. Reuss shared a dominant theme: integrated or holistic analysis of whole watersheds or river basins. But they shared a common fate as well. They were ignored, adopted in name but not in reality, or not implemented.

The most recent formal (legislative) revival of watershed management came in the 1960s and 1970s, especially in the Water Resources Planning Act of 1965 (WRPA)[2], and in section 208 of the 1972 Clean Water Act (CWA).[3] With the political demise (but not repeal) of those national programs, watershed protection programs subsided for a time, but have returned in force in recent years. Renewed proposals for watershed programs have come from diverse and broadly representative sources, including Water Quality 2000,[4] the Long's Peak Working Group,[5] politicians,[6] a working group of the National Academy of Sciences,[7] the Association of Metropolitan Sewerage Agencies (AMSA),[8] EPA,[9] and citizens.[10] While each proposal differs to some degree, all promote the theme of restoring and protecting the nation's aquatic resources on a holistic basis, taking into account all causes of impairment to target watersheds, together with the connected land and water resources. Perhaps most important, the quiescence of national watershed programs has not deterred the development and implementation of watershed programs at the local, state and regional levels. Of course, numbers say nothing about the quality of current watershed-based approaches.

The resurgence of watershed proposals comes from diverse perspectives. The hydrologic definition of "watershed" is fairly consistent and straightforward. Definitions of "watershed management" or "watershed protection," however, vary considerably, reflecting differing

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Endnotes are on pages 20–23.

perspectives of different governmental and interest groups. General agreement on the virtues of "watershed something" is not synonymous with consensus on what that "something" is, or should be, much less on the harder questions of how watershed-based approaches should be implemented. Even the desired *outcome* of watershed programs has varied considerably throughout the past century, and continues to vary depending on the perspective of the proponent. As a result, some question whether the term "watershed protection" is too vague or rhetorical to be of significant use.[11]

Yet the ongoing watershed revival is too broad-based, and its underlying rationales too compelling, to be so readily dismissed. The question is whether, unlike previous proposals, the watershed movement of the 1990s can produce adequate results to ensure its longevity. This paper seeks to identify, and to propose ways to overcome, the core barriers to watershed protection programs.

II. Imperatives for Watershed-Based Restoration and Protection

A. *Ecological Imperatives for Watershed Programs*

The declining health of aquatic species and ecosystems in the United States[12] shows that something is dramatically wrong with our water resource policies. The need for watershed-based remedies is strongly suggested by a synthesis of three factors: (1) the nature of aquatic ecosystems, including the interaction between land and water resources, links between water quantity and quality and between groundwater and surface water, and the heterogeneity (variability) of aquatic ecosystems; (2) the ongoing decline of aquatic species and ecosystems despite the implementation of point-source pollution control programs and other "engineered" solutions; and (3) the nature of the major remaining sources of impairment, including habitat loss and alteration, polluted runoff (nonpoint-source pollution), and declining instream flows, none of which are addressed well by existing source-specific programs.

B. *Institutional Imperatives for Watershed Programs*

It is difficult to imagine a political and institutional system as complicated and as fragmented as that used for protecting and managing water resources in the United States. The resulting anarchy in water programs has been identified by scholars and managers from virtually every relevant field. Thus, several institutional imperatives support the need for watershed-based approaches:

- *political* fragmentation—the overlapping and conflicting division of responsibilities among multiple levels of government and agencies;
- *issue* fragmentation—the artificial division of related water issues into separate programs (such as water quality and quantity, land and water use, surface and ground water); and
- *gaps* in *program design* and *implementation*.

C. *Economic Imperatives for Watershed Programs*

Given the current and foreseeable fiscal climate in the United States, resources for water system protection and restoration are inadequate and increasingly scarce.[13] While protection of water resources deserves increased financial attention,[14] political realities suggest that more must be done with less, at least in the near term. Point-source-dominated programs are challenged on grounds that they impose "treatment for treatment's sake," and that point sources have borne the lion's share of the water pollution control burden, while other significant causes of impairment escape with few or any requirements.[15] Increased calls to prove that the benefits of investments in water protection exceed the costs, and that the most cost-effective solutions to water protection are being chosen, suggest that restoration and protection programs be chosen to obtain the greatest results per dollar of private and public investment.[16] This suggests two economic imperatives for watershed programs: (1) equity between point sources, nonpoint sources and other sources of harm; and (2) efficiency in the use of scarce public and private resources.

D. *Sociological Imperatives for Watershed Programs—Bioregionalism and the Conservation Ethic*

Lurking behind these scientific, institutional and economic rationales for watershed programs is a more profound imperative: the idea that people are more willing to take actions and to make sacrifices to protect and restore a special place—like the Great Lakes or the Chesapeake Bay or the Columbia River—than to promote some abstract idea of environmental quality. This drive, more than any technical reason, may explain the groundswell of "place-based" initiatives identified by EPA,[17] "river-oriented community revitalization projects" lauded by citizen activists,[18] and regional coalitions rallying around the protection of particular water systems.[19]

This trend can be explained as a manifestation of the evolving concept of *bioregionalism*, increased allegiance to place,[20] the energy of which can be harnessed to overcome two frequent obstacles to watershed programs. One obstacle is the parochial tendency to resist regional cooperation to protect and restore watersheds and other ecosystems. A second hurdle is the gap between the theory of a conservation ethic in the United States and its practice (or absence thereof) by individuals in homes and workplaces.

Thus, bioregionalism adds two compelling sociological reasons to support watershed protection and restoration. In contrast to traditional loyalties to geopolitical boundaries, organizing efforts around bioregions defined by the watersheds of important bodies of water can help to overcome political parochialism. This shared sense of place also can be used to provide public support for funding[21] and strengthened water resource protection and restoration programs, as well as the willingness of citizens to devote personal time to grassroots watershed restoration.[22]

Second, many causes of water resource impairment result from the cumulative impacts of large numbers of people across the full spectrum of human activities. Because the actions

of so many individuals defy traditional regulatory approaches,[23] this source of "people pollution" arguably can be overcome only through the attainment of Aldo Leopold's "land ethic," under which "[c]onservation is a state of harmony between [people] and land," and in which we extend "the social conscience from people to land" and instill in the public at large "individual responsibility for the health of the land."[24] While Leopold and others generated the idea of a conservation ethic, there is a "great disparity between the idealistic commitment to conservation and the actual behavior of people who managed natural resources."[25] Just as individuals are more likely to spend money and time to protect and restore a special local or regional water body than an abstract concept of environmental quality, in some cases bioregionalism could help to transform the theoretical conservation ethic into changes in the behavior of individuals within their own watersheds.[26]

III. U.S. Watershed Legislation Past and Present

> I realize that for many, watershed management represents a new way of thinking.
>
> —Vice-President Al Gore[27]

Watershed management has a long history in the United States. Early watershed proposals during the Progressive era died outright. Others were transformed into utilitarian programs to optimize use and development of water resources in ways that did far more to degrade than to protect aquatic ecosystem health. The third, most recent set of watershed authorities grew out of the environmental era in the 1960s and 1970s.

A. *The Watershed Legislative Graveyard*

Many credit John Wesley Powell, who recommended that states be organized around watershed boundaries and that Congress help to maximize the development of land and water resources to promote settlement of arid lands in the West, with giving birth to the idea of comprehensive watershed or river basin management.[28] These ideas led in two apparently related but ultimately opposite directions. The first was comprehensive, integrated approaches to watershed management remarkably similar to those being proposed today: as proposed by the 1908 Inland Waterways Commission, the 1909 National Conservation Commission, the 1912 National Waterways Commission, and the authorized but never formed 1917 Newlands Commission. The second was to promote massive federal spending on large, structural water projects to optimize and "manage" the use and value of water for human benefits, reflected in laws such as the Reclamation Act of 1902,[29] the Federal Power Act of 1920,[30] and the Flood Control Act of 1936.[31]

A broader view of comprehensive river basin planning returned during the New Deal, in proposals by the National Planning Board, the Water Resources Committee (WRC) of the National Resources Commission, and the National Resources Planning Board. Like the Progressive era proposals before them, however, the New Deal watershed proposals were rooted fundamentally in human use and economic development. Moreover, like Progressive

era antecedents, the New Deal proposals were rejected by Congress as well, with the notable exception of TVA. One principal reason was opposition to central planning for watersheds or any other purpose.

River basin planning finally attracted Congress' attention with the formation of the Senate Select Committee on National Water Resources in 1959, which led ultimately to the Water Resources Planning Act of 1965 (WRPA).[32] The WRPA was never formally repealed, although it failed to accomplish its mission of comprehensive basin planning on a national scale. Instead, the WRC and all of the Title II Commissions were disbanded by President Reagan in 1981, although more for reasons of fiscal conservatism than because of policy flaws.[33]

B. *Emerging and Latent Authority for Watershed Protection and Restoration*

Much federal statutory authority for watershed-based restoration and protection remains, with varying degrees of usefulness. Some authority exists in predictable laws, while some is concealed in surprising places. Existing federal authority includes the Clean Water Act, other environmental protection statutes,[34] federal land management statutes,[35] and a large number of regional watershed protection or management programs.[36] Many authorities to support watershed protection and restoration are included in various agricultural programs as well. But while individual success stories abound, and other new programs show some promise, given empirical data on the state of our aquatic ecosystems, it is hard to argue that these programs are succeeding on an overall basis. The design and implementation of future watershed programs must be improved if we are to meet aquatic ecosystem restoration goals.

IV. Looking to Future Watershed Programs: Paradoxes in Design and Implementation

Watershed approaches likely will continue to be pursued over the next 10 and 50 years in an effort to resolve serious ongoing water quality and aquatic ecosystem problems. Based on the foregoing inquiry, the resolution of several key issues will be crucial to the success of future watershed programs. These involve questions of (1) *scale,* (2) *boundary,* (3) *control,* and (4) *mission*. Unfortunately, each has a series of accompanying paradoxes that make solutions elusive. This analysis seeks to identify the most important of these issues and paradoxes, and to suggest at least some potential solutions.

A. *Scale*

Serious disagreement arises over the appropriate scale for watershed programs, reflecting a tension between ecological and political factors. A related debate is whether programs should be organized and managed from the "ground up" or the "top down."

The existence of hydrologic and ecological connections and interactions between components of aquatic ecosystems over large geographic areas suggests that watershed

programs should proceed at the scale of whole river basins or other broad hydrologic regions, such as the Ohio River Basin or the Chesapeake Bay. Programs of broad regional scale, however, face significant political and institutional problems. Larger watersheds are likely to cross more political boundaries (city, county, state or national), resulting in greater need for intergovernmental coordination.[37]

Watershed programs at a smaller scale can be designed and implemented by those closest to the problem, taking into account the physical and sociopolitical conditions of the area. Solutions may be more cost-effective because they are tailored to the area's problems and conditions. Voluntary participation and compliance with regulatory requirements may be more willing when regulated entities and the public are involved in the formulation of programs and standards, and when they understand the link between observing those norms and the health of their watershed. On the other hand, small watershed programs lack the focus and scope necessary to address expansive hydrological and ecological linkages over space and time. Small programs might solve local problems while ignoring or exacerbating conditions in other areas. Standards may vary significantly in stringency and effectiveness.

Thus, there is a tension between the practical objectives of efficiency and flexibility and the equally important goals of equity and accountability. The solution to this paradox of scale may be "all of the above." The suggestion that watershed restoration and protection programs should be designed at a single scale—small, medium or large—is like asking a physicist whether the nature of the universe should be studied and explained at the subatomic, atomic, molecular, systems, or cosmic scale. Knowledge and understanding of all levels, as well as the interaction between these different scales, is essential to comprehensive understanding of the physical universe. The same is true for watersheds. As suggested by Water Quality 2000, watershed programs should be planned and implemented at multiple, nested scales,[38] with roles and responsibilities allocated as appropriate to each scale.

Thus, the largest watershed units should address issues of regional planning, assessment and coordination, to ensure that regional impacts and connections are understood and addressed, and to establish regional goals and objectives.[39] Small watershed units—like those in the NRCS small watershed program—would focus more on design and implementation of on-the-ground controls.[40] It is critical, however, that nested scales of watershed organization operate in cooperation rather than in isolation or in competition. The broadest level should include representatives of each lower scale of organization, to facilitate accommodation of local needs and goals. Personnel from regional levels should participate in and observe firsthand the methods and problems of implementation. To avoid the "top down" versus "bottom up" paradox, information and decisions should flow in both directions.

B. *Boundary*

Closely related to, but distinct from, the problem of scale is the question of boundary delineation. All proponents of watershed approaches agree that aquatic ecosystem restora-

tion and protection programs should be organized according to natural rather than artificial boundaries. But because natural ecosystem boundaries vary significantly depending on the resource being addressed, the task of boundary delineation is not as simple as it seems.

No agreement has been reached on a single framework for ecosystem boundaries. Many advocate programs based on watershed boundaries, while others suggest that watershed *ecosystems* reflect more accurate ecological boundaries. But a variety of aquatic ecosystem boundaries could be identified: "salmonsheds" versus "ducksheds," for example. The parallel trend towards comprehensive management of terrestrial ecosystems makes the situation even more complex. Should land use programs be based on watersheds, "forestsheds" or "bearsheds"? A farmer might lose patience if the same set of activities were regulated through conflicting rules to manage waterfowl within a flyway ecosystem, runoff to a riparian basin, and the habitat of wolves migrating across his or her land. A land manager may have no time to manage if he or she needs first to coordinate with multiple watershed and ecosystem efforts, such as the Greater Yellowstone ecosystem for some activities and the Yellowstone River watershed for others. The public may lose trust if management plans increase but resource protection declines.

There is probably no single answer to this paradox, i.e., no single ecosystem delineation is more "correct" than others. What is clear, however, is that unless agreement is reached on some consistent framework for ecosystem-based programs, including watershed programs, management anarchy may result.

C. *Control*

Related closely to both the questions of scale and boundary is the pivotal matter of control. One of the principal advantages of comprehensive watershed (or ecosystem) approaches is that they can coordinate the efforts of multiple entities within multiple levels of government. A second major benefit is that watershed approaches provide flexibility to account for regional variables in designing and implementing programs, so long as legitimate regional and national goals are met. Ironically, however, a major source of opposition to comprehensive watershed planning and management comes from lower levels of government who fear that they might sacrifice control over land use, economic and environmental policies. Thus, a paradox exists between the U.S. tradition of local rule within geopolitical boundaries versus the need to coordinate efforts within watershed or ecological boundaries.

The history of past watershed program failures (like the rejected New Deal programs, the WRPA and CWA SS208), particularly in the current political climate with its shift back towards state and local rule, suggests strongly that this tension may be exacerbated by efforts to drive uniform watershed programs out of Washington, D.C. History provides equally clear lessons, however, that leaving water policy decisions entirely to states and localities results in geographic externalities, economic inequities, and programs too weak to make a real difference.

A reasonable balance must be struck between these two extremes if we are to make progress in restoring and protecting our aquatic ecosystems. Despite the recent rash of "fed-bashing," a strong federal presence is essential when most aquatic ecosystems cross so many state and international boundaries, and to ensure that reasonably equal progress is made and goals are met around the country. But uniform federal regulation of land use will continue to attract significant opposition, and is not appropriate in all cases. Programs like the National Estuary Program and the Coastal Nonpoint Source Runoff Program in the CZMA suggest that such a balance is possible, but it must be achieved at a national scale and not just in the coastal zone.

D. *Mission*

A further paradox arises over the fundamental nature of watershed programs. Is the purpose of a comprehensive watershed approach largely procedural or substantive? To some, the basic purpose of watershed programs is to ensure that the correct players from diverse locations and interests have adequate opportunity to interact, express their views, and reach consensus on watershed goals and actions to meet those goals. This reflects an optimistic but naive view that process alone will be sufficient to resolve intractable conflicts within and among watersheds.

History suggests that this optimism may be misplaced. The Coastal Zone Management Act, for example, requires rigorous efforts to ensure intergovernmental coordination and public participation. The Fish and Wildlife Coordination Act and the National Environmental Policy Act also require significant intergovernmental consultation and public process. None of these process laws alone, however, has significantly reduced the impairment of aquatic ecosystems at large, although undoubtedly they have helped to mitigate impacts from individual activities.

Where federal watershed programs have included substantive mandates, however, with the exception of the CWA they have done more harm than good. The CWA, in turn, with due respect to sections 208 and 319, lacks an adequate planning and management framework to address pollution from diverse land uses. The substantive mandates of federal water programs such as the Reclamation Act, the Federal Power Act, and the various water resource development laws, as well as the "multiple use" doctrine in most of our public lands laws, have done more to impair than to restore or protect our aquatic ecosystems.

True watershed restoration and protection programs, then, cannot be substance-neutral. They must be driven by a clear and enforceable substantive mandate to restore and protect aquatic ecosystems. The details of implementation can and should be addressed at the regional and local scales, as appropriate. The overriding program objectives, however, cannot be left to chance.

V. Conclusion

Symposium authors were asked not only to address past and current conditions, but to forecast trends ten and fifty years into the future. Given the political, economic, environmental and social complexities inherent in watershed management, this task cannot be performed with great precision. It is reasonably clear that, judged on a national scale, most past watershed-based efforts have failed for a variety of reasons. The current watershed resurgence shows more promise, in part due to our ability to learn from past mistakes, but we are a long way from restoring the health of our aquatic ecosystems.

In the twenty years since passage of the 1972 Clean Water Act we have seen significant improvements in water quality resulting from point-source controls (although considerable additional challenges remain). The sad truth is that we are not likely to see similar improvements in water quality from nonpoint-source controls in a single decade, at least not on a national scale. The problems are simply too widespread, and solutions will take too long to design and implement. And only if we successfully address the issues and paradoxes discussed above are such improvements likely over the next fifty years.

Notes

1. Martin Reuss, ed., *Water Resources Administration in the United States* 1 (American Water Resources Association, Michigan State University Press, 1993) (hereafter cited as *Water Administration*).

2. U.S. Code, vol. 42, sec. 1962 et seq.

3. U.S. Code, vol. 33, sec. 1288.

4. Water Quality 2000, *A National Water Agenda for the 21st Century, Phase III Report* (Water Environment Federation 1992) (hereafter *WQ 2000*). Water Quality 2000 was a multi-interest group forum, convened by the Water Pollution Control Federation (renamed the Water Environment Federation) to negotiate consensus on long-range U.S. water quality policy. The Final Report was ratified by representatives of industry, agriculture, environmental groups, all levels of government, educators, scientists and professionals.

5. *America's Waters: A New Era of Sustainability, Report of the Long's Peak Working Group on National Water Policy*, reprinted in 24 *Environmental Law* 125 (1994) (hereafter *Long's Peak Report*). The Long's Peak effort was convened by the Natural Resources Law Center of the University of Colorado to.propose changes in water policy for the Clinton-Gore Administration. While somewhat less broadly representative than Water Quality 2000, the effort nevertheless included individuals from academia, states, Native Americans, environmental groups, Congress, and others.

6. Mark O. Hatfield, "The Long's Peak Working Group and River Basin Trusts," 24 *Environmental Law* 145 (1994).

7. National Research Council, *Restoration of Aquatic Ecosystems* (hereafter *Aquatic Restoration*) (Washington: National Academy Press, 1992).

8. Association of Metropolitan Sewerage Agencies, *The Comprehensive Watershed Management Act of 1993* (March 1993).

9. U.S. Environmental Protection Agency (USEPA), Office of Water, *The Watershed Protection Approach*, Annual Report 1992 (1993); USEPA, *NPDES Watershed Strategy* (March 1994); Robert Perciasepe, Assistant Administrator for Water, USEPA, memorandum re: The Watershed Approach: Our Framework for Ecosystem Protection (October 7, 1994).

10. E.g., Bob Doppelt, Mary Scurlock, Chris Frissel and James Karr, *Entering the Watershed: A New Approach to Save America's River Ecosystems* (Island Press 1993) and Robert W. Adler, Jessica C. Landman and Diane M. Cameron, *The Clean Water Act 20 Years Later* (Island Press 1993).

11. William Goldfarb, "Watershed Management: Slogan or Solution," 21 *Boston College Environmental Affairs Law Review* 483 (1994).

12. See Adler et al., note 10; *Aquatic Restoration*, note 7.

13. Bruce D. Long, "Water Resources Development at a Crossroads," in *Water Administration* (note 1), pp. 258–61. On current shortfalls in funding, see Adler et al. (note 10), pp. 109–10.

14. Adler et al. (note 10), pp. 87–115 (evaluating the economic value of water resources); Doppelt, et al. (note 10), pp. 4–6. This is not meant to imply agreement with the notion that economic "benefits" of water resources can be measured precisely and offset against costs of protection. Then-Senator Al Gore aptly quoted Oscar Wilde: "A cynic is one who knows the cost of everything, but the value of nothing" (Gore, *Earth in the Balance*). Aldo Leopold wrote: "Now we face the question whether a still higher 'standard of living' is worth its cost in things natural, wild, and free." —Foreword to *A Sand County Almanac* (New York: Oxford University Press, 1949), vii.

15. J.B. Braden, N.R. Netusil, and R. Kosobud, "Incentive-Based Approaches to Nonpoint-source Pollution Abatement in a Reauthorized Clean Water Act," *Water Resources Bulletin* 30 (1994); William F. Pedersen, Jr., "Turning the Tide on Water Quality," 15 *Ecology Law Quarterly* 69, 82–84 (1988).

16. Again, this does not imply agreement with the notion that current cost-benefit analysis-or cost-effectiveness evaluation methods capture fully the economic costs and values of clean water and healthy aquatic ecosystems. For a critique of these concepts, see Robert W. Adler, "Reauthorizing the Clean Water Act: Looking to Tangible Values," *Water Resources Bulletin* 30(1): 6–8 (1994). But it is easy to agree with the general principle that we should strive to achieve the greatest water resource benefits per dollar invested.

17. Perciasepe Memorandum (note 9), p. 1 (identifying over 130 place-based water initiatives supported by USEPA).

18. Doppelt, et al. (note 10), p. 34.

19. A few of many examples include Great Lakes United, the Long Island Sound Alliance, The Alliance for the Chesapeake Bay, and the relatively new Mississippi River Watershed Alliance.

20. For explanations of bioregionalism, see James J. Parson, "On 'Bioregionalism' and 'Watershed Consciousness,' " *Professional Geographer* 37: 1 (1985); Donald Alexander, "Bioregionalism: Science or Sensibility?", *Environmental Ethics* 12: 161–171 (1990); Jonathan Z. Cannon, "Geographic Approaches to Environmental Management: Bioregionalism Applied," in *Watershed 93: A National Conference on Watershed Management*, pp. 281–85.

21. This can come in the form of public support for increased governmental spending to protect place-based water resources, or willingness to pay higher water and sewer fees if citizens believe those funds are to protect special water bodies. For example, the original

goal of the Chesapeake Bay license-plate fund was to sell 100,000 special plates within two years. This goal was met in three months, with 430,000 plates sold in two years. Ann Pesiri Swanson, "The Chesapeake Bay: A Case Study in Watershed Management," in *Watershed 93* (note 20), pp. 43, 44.

22. Again using the Chesapeake Bay as an example, more than 160 citizens are involved in monitoring 135 sites in 3 states through the Chesapeake Bay Citizen Monitoring Program. Kathleen Ellett, "Involvement of Citizen Volunteers in Watershed Management in the Chesapeake Bay Region," in *Watershed 93* (note 20), p. 873. Similar monitoring efforts are in place around the country. Karen Firehock, "The Save Our Streams (SOS) Program," in *Watershed 93*, pp. 447–50.

23. "There is far less need for coercion and formal social control when people voluntarily, or habitually, adhere to patterns of behavior." —Robert G. Lee, "Ecologically Effective Social Organization as a Requirement for Sustaining Watershed Ecosystems," in Robert J. Naiman (ed.), *Watershed Management, Balancing Sustainability and Environmental Change* (Springer-Verlag 1992), pp. 73, 80.

24. Leopold (note 14), pp. 207, 209, 221. The concepts of "individual and collective responsibility for water resources" and pollution prevention by all sectors of the economy were imbedded into the Water Quality 2000 recommendations, in concert with watershed-based approaches. *WQ 2000* (note 4), pp. 15–32.

25. Lee (note 23), p. 79.

26. In a wonderful essay, professor Eric Freyfogle described "place people" as those "who have roots to a particular spot, people who have the knowledge and sensitivity to note evidence of illness and to challenge claims that degradation will bring overall good. People who-know a place intimately develop an emotional bond that transcends the personal and the temporary. . . . Place people are most likely to sense that the land is not simply a tool, not simply something to put to use according to our latest economic calculations." Eric T. Freyfogle, "Ownership and Ecology," *Case Western Reserve Law Review* 43: 1269, 1291 (1993).

27. Introductory letter from Vice-President Al Gore to the participants of the Watershed 93 Conference (note 20), dated March 24, 1993.

28. Rutherford H. Platt, "Geographers and Water Resource Policy," in *Water Administration* (note 1), p. 37. Platt credits George Perkins Marsh as well, but notes that Marsh championed a preservation ethic while Powell promoted what would become the Progressive era's conservation doctrine of "wise use" of land and water resources.

29. U.S. Code, vol. 43, sec. 372 et seq. (as amended).

30. U.S. Code, vol. 16, sec. 791a et seq. (as amended).

31. U.S. Code, vol. 33, sec. 701 et seq. (as amended).

32. Pub. L. 89-80, 79 Stat. 244 et seq. (1965), codified as amended in U.S. Code, vol. 42, sec. 1962 et seq.

33. The Commissions all were terminated by Executive Order. See 42 U.S.C.A., sec. 1962b (Historical and Statutory Notes).

34. These include the Fish and Wildlife Coordination Act, the National Environmental Policy Act (NEPA), the Endangered Species Act, and the Safe Drinking Water Act.

35. These include the National Park Service Organic Act, the Multiple Use and Sustained Yield Act, the National Forest Management Act, the Federal Land Policy and Management Act, the Fish and Wildlife Administration Act, the Wild and Scenic Rivers Act, and the Wilderness Act.

36. These include the Coastal Zone Management Act, the Tennessee Valley Authority Act, the Pacific Northwest Electric Power Planning Act, the Colorado River Salinity Control Act, several place-based provisions of the Clean Water Act (Great Lakes, Chesapeake Bay, Long Island Sound, Lake Champlain, National Estuaries Program, Clean Lakes), and several interstate water pollution compacts (Potomac River, Ohio River, Delaware River, Susquehanna River).

37. Each local jurisdiction adds more than one new player since each is likely to have multiple affected offices or entities even at the most local scale (water, sewer, flood and stormwater control, zoning and land use, etc.). Each new state similarly adds multiple players (water quantity, water quality, fish and wildlife, transportation, commerce, energy, etc.).

38. WQ 2000 recommended that the nested watershed programs be organized using the USGS cataloging system. While this approach would be convenient because USGS watersheds are already delineated and mapped, it is not necessarily the only valid organization.

39. Examples would be the issuance of consistent or at least coordinated water quality standards for water bodies common to the basin; or evaluation of basinwide impacts and control targets, such as the regional nutrient evaluation of the Chesapeake Bay and the resulting nutrient reduction target.

40. This approach makes the most sense in the context of management practices to address runoff pollution, for which successful solutions at the national scale have been elusive, and for habitat restoration and protection efforts that are highly site-specific. Problems that are amenable to relatively uniform national requirements, such as technology-based controls for point sources, should remain subject to those programs.

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